MATHEMATICAL AND COMPUTATIONAL SCIENCES
DIVISION COLLOQUIUM

DIRECT BLIND DECONVOLUTION

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ABSTRACT

Blind deconvolution seeks to deblur an image without knowing the cause of the blur. Iterative methods are commonly applied to that problem, but the iterative process is slow, uncertain, and often ill-behaved. This paper considers a significant but limited class of blurs that can be expressed as convolutions of 2-D symmetric Lévy 'stable' probability density functions. This class includes and generalizes Gaussian and Lorentzian distributions. For such blurs, methods are developed that can detect the point spread function from 1-D Fourier analysis of the blurred image. A separate image deblurring technique uses this detected point spread function to deblur the image. Each of these two steps uses direct non-iterative methods, and requires interactive adjustment of parameters. As a result, blind deblurring of 512×512 images can be accomplished in minutes of CPU time on current desktop workstations. Numerous blind experiments on synthetic data show that for a given blurred image, several distinct point spread functions may be detected that lead to useful, yet visually distinct reconstructions.

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